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ABSTRACT

This project has been directed towards the development of procedures for assessing children's curiosity. Better procedures are needed to reach one of the long-range goals of Center Program III: an understanding of the relationship of curiosity to academic achievement and other cognitive skills, styles and motives. This paper reviews briefly some existing curiosity assessment procedures and reports the development of two new measures: the Behavior Profile (BP), used by teachers to rate curiosity (BPC), achievement strivings (BPA), and achievement blocks (BPB): and the Incongruity Game, used to make a direct assessment of curiosity behavior under controlled conditions. Data were collected on these variables and many others for a sample of white middle class children in grades 1-3. The Incongruity Game did not relate in predicted ways to other variables, but the Behavior Profile curiosity subscale did. Among the major findings for the curiosity scale are these: (1) high reliability, (2) positive associations with grades, problem-solving flexibility, and scores on recall of novel information; and (3) somewhat different patterns of relationship among the three Behavior Profile subscale scores, IQ, and cognitive-academic performance for boys and for girls. A selection of findings for BPA and BPB is also presented. (Author)

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THE JOHNS HOPKINS UNIVERSITY

REPORT NO. 56

THE DEVELOPMENT OF NEW MEASURES OF CURIOSITY FOR CHILDREN

BY

ELLEN GREENBERGER

DECEMBER, 1969

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The Development of New Measures of Curiosity for Children

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BACKGROUND

Research on human and infra-human curiosity deals with a surprising galaxy of behaviors: visual attention, manipulation, play, and the quest for knowledge, to name the most common. Equally numerous are the stimulus variables that appear to evoke such behaviors. They include novelty, complexity, surprisingness, and for human subjects, incongruity. (See Berlyne, 1960, for definitions of these terms.) The fact that such behavior exists from infancy has been amply demonstrated for both human and lower organisms (Berlyne, 1958 ; Fantz, 1961; Harlow, 1958; Piaget, 1952). Relatively little is known, however, about the course of development of curiosity during the childhood years, the factors underlying individual differences in curiosity, or the extent to which the school utilizes and nurtures (versus ignores or inhibits) curiosity. Answers to questions like these await improvements in the definition and conceptualization of curiosity and the development of good assessment procedures. Such issues should be of special interest to educators, since a mode of behavior characterized by approach and exploration of the new seems highly conducive to learning.

Previous research on children's curiosity falls into two categories: ratings of the child by others and by self; and assessment of behaviors under controlled laboratory or laboratory-like conditions. Each type has its problems and neither has been resoundingly

successful in turning up knowledge about the antecedents, course of development, and correlates of curiosity.

Thus far the majority of experimental work on human curiosity has centered on visual exploration and the nature of stimuli that attract the longest attention (Berlyne, 1954; 1957; 1960; 1963; Cantor, 1963; Cantor, Cantor and Ditrichs, 1963; Smock and Holt, 1962). A typical study investigates the differential amount of viewing time allotted pictures (often of abstract shapes) that differ in complexity, incongruity, and other stimulus attributes mentioned earlier. Some investigators have argued that the variety of stimuli which other researchers have come to regard as curiosity-evoking may not be functionally equivalent; and that visual attention or scanning, while a fundamental part of many approach behaviors we might categorize under the heading of curiosity, is not a satisfactory operational definition of the latter. Attention and viewing preferences are affected by many factors other than curiosity, including the need for stimulation (stimulus-seeking) and avoidance behaviors quite antithetical to curiosity, such as fear.

Rating procedures also contain problems in the definition of curiosity. Typically, they survey a wider range of behavior than experimental studies, sometimes perhaps extending the concept of curiosity beyond theoretically sound proportions. In many assessment procedures, boredom-based exploration or stimulus-seeking is confounded with information seeking.[1] Thus, Penney and McCann (1964) have attempted to measure "reactive curiosity", the high-scoring child being one who "approaches and explores new situations,

incongruous and complex stimuli, and ... seeks to vary his stimulation in the presence of frequently experienced stimulation." Sample true-false items from the Reactive Curiosity Scale are: "I like to eat the same kind of food most of the time" (F) and "I like to tell others about things I have seen or done" (T). Maw and Maw (1964, 1965) have developed curiosity-rating procedures for use by teachers and by peers. While the teacher and peer prodecures differ substantially, both depend on this definition: (1) reacts positively to new, strange, incongruous or mysterious elements in the environment by moving toward, exploring, or manipulating them; (2) exhibits a need or desire to know about himself and/or his environment; (3) scans his surroundings seeking new experiences; and (4) persists in examining and exploring stimuli in order to know more about them. This definition, like Penney and McCann's, incorporates stimulus-seeking (3), more goal-directed, information-seeking behaviors (2, 4), and a behavior whose aim is ambiguous (1).

In addition to problems in initial conceptualization, existing procedures for assessing curiosity have other limitations. Test-retest reliability of the Reactive Curiosity Scale is adequate, but its validity is essentially unknown. Positive relationships with measures of originality were predicted, but in a study of fourth, fifth and sixth graders; the prediction was confirmed only for sixth grade children. (Loaded as the scale appears to be with non-cognitive, stimulus-seeking activities, it is not clear that their prediction was based on firm ground.) A consistent, unpredicted sex difference was found with girls scoring higher than boys. This finding is somewhat

at odds with conventional wisdom about sex differences in curiosity and with other findings (Mendel, 1965; Maw and Maw, 1965). At the least, better understanding of what "kind" of curiosity the scale is measuring is necessary.

No information is reported by Maw and Maw on the reliability of their teacher or peer procedures. Our remarks will be confined to the teacher ratings, which have been described more fully than the peer procedure in their publications. Teachers rank pupils on the basis of the composite criterion outlined earlier, beginning at the extremes and working "in" towards the middle. Maw and Maw's research has turned up many interesting, if not entirely coherent, findings. Some of the findings may be viewed as validating the rating procedure: for example, children rated high versus low differ significantly on an independent estimate of breadth of information and the quantity and quality of their questions (Maw and Maw, 1966). The main problems with the procedure are: (a) possible non-uniformity in relative emphasis of different raters on the four parts of the composite criterion, (b) unexplored relation to measures of halo effect, (c) puzzling outcomes such as a failure to find differences in the child-rearing practices (measured by PARI) of families with girls ranked at opposite extremes of curiosity, and (d) doubtful utility for discriminating among individuals whose curiosity is in the middle range of the continuum.

The present research is an attempt to develop two new procedures for assessing curiosity in young children. Better instruments are needed to reach the long-range goal of understanding the relationship of curiosity to academic achievement and other cognitive skills, styles,

and motives. Both of the new procedures share a common theoretical point of view. They emphasize an active, cognitive conceptualization of curiosity, as opposed to mere boredom-avoidance or stimulus seeking. Specifically, we view curiosity as a strategy for dealing with uncertainty. Uncertainty is produced by novelty, incongruity, surprise, and ambiguity. Curiosity involves (1) willingness to allow stimuli of this nature to become the focus of conscious attention (to become "signals"). The alternative is rejection of uncertainty, as in dismissing such events from attention; or even outright failure to perceive stimuli with uncertainty properties, in the manner of perceptual defense. Curiosity also involves (2) various coding processes by which one tries to make sense of things that are novel or perplexing. New information may be acquired through overt exploration, inquiry, or implicit problem-solving. The end product of these coding operations is to bring the experience into one's usable cognitive map of the world. This conceptualization was initially proposed by Beswick (1964). It is compatible with (and draws heavily on) Berlyne's thinking and with the views of Maddi (1961).

The new cognitively-oriented measures of curiosity should exhibit certain predictable relationships to other variables. Obviously, the measures should relate to each other and to similarly conceived measures of curiosity. Since success in making sense of novel or perplexing events depends to some extent on IQ, and since success will reinforce the coding efforts, a positive relationship with IQ is expected. (A good curiosity measure, however, should measure something more than general intelligence.) It is also predicted that scores on the new curiosity measures should be positively related to indices of learning and problem-solving skill.

METHOD

The following sections describe the development and testing of two new curiosity assessment devices: the Student Behavior Profile and the Incongruity Game.

Development of curiosity measures

1. Student Behavior Profile

A 35-item rating scale for use by teachers was devised in connection with the long-range goals described above. It yields scores on curiosity, achievement strivings, and achievement blocks. Fourteen of the items are pertinent to curiosity and thirteen to the general area of achievement motivation; eight are filler items. The order and direction of items is shown in Appendix A. All items (descriptions or judgments of children's classroom behavior) are rated on a 9-point scale and separate totals are formed for three subscales: curiosity, achievement strivings, and achievement blocks.

The curiosity items include several directly suggested by Beswick's (1964) scoring scheme for a TAT-type measure of curiosity imagery.[2] The curiosity items are:

Tends to wonder about, become fascinated by, a variety of things
Has developed a long-term interest in a single task or project
Examines, observes, notices carefully
Gets excited, interested, when something new or unexpected is introduced
Tries to figure things out
Actually experiments, tries things out
Often raises questions and problems
Interrupts with questions during lessons
Likes to try to solve problems
Would rather hear a new than a familiar story
Tries to touch, or asks questions about the new or unexpected
Loves to learn new things
Doesn't mind working hard to find the answer to a question he has asked
Likes to have his expectations about things disconfirmed

The achievement subscales are not of major interest to us here but will be used to shed light on the meaning of the curiosity procedures and findings. The achievement items were derived from McClelland's (1953) model of an achievement-motivated behavior sequence. This model is familiar to many psychologists and sociologists in its reduction to a procedure for scoring "need achievement" from verbal materials, especially story-productions.

These items are:

Has a strong need to do things well
Feels great pleasure when he has done something well
Tries hard to do well in schoolwork: practices, drills, studies
Spontaneously tries again when he has failed
Wants to do better than others in his schoolwork
Probably someone at home is sympathetic to his wish to do well
Feels bad when he has not done something well

Achievement blocks are assessed separately from achievement drive:

Expects to do poorly
Things happen (accidents, forgetting, etc.) that interfere with his achievement
Seems blocked in his ability to do well

Finally, previous work by Greenberger & Alper (1967), Sears (1962), Lansky et al.(1961) and others has suggested that achievement may be a means to other ends. These two contrasting items were included for exploratory purposes:

Tries to do well in hopes of winning approval
Tries to do well because he likes feeling competent

Ratings on three sets of items (curiosity, achievement, and blocks) are summed to give three subscale scores. In the research described below, it was necessary to standardize scores because of differences among the seven teachers in rating styles".[4]

2. The Incongruity Game

Curiosity is defined more narrowly in this procedure than in the Student Behavior Profile. This game evaluates interest in incongruity and persistence in resolving it.

Several investigators have noted the particular potency of incongruous stimuli (compared with ambiguous or complex stimuli) to evoke attention or the desire for more information. (Berlyne & Frommer, 1966; Greenberger, Woldman & Yourshaw, 1967; Smock & Holt, 1962). Incongruity is defined in these studies as a physical or mental event, one part of which conflicts with expectations aroused by the remainder. Clashes of this kind are likely to initiate exploration.

A game was devised which consists of eight pairs of pictures and a set of about 15 items corresponding to each picture. One member of each pair is a "normal" picture; the other is identical except for inclusion of some obvious incongruity. Examples are a bird sitting in a nest in a tree vs. a dog sitting in the nest; a horse with a saddle vs. a cow wearing a saddle; and a barefoot girl leaving footprints as she walks vs. the same girl apparently leaving enormous shoeprints. The child indicates which member of a pair he wishes to know more about and then can obtain one piece of information for each poker chip he gives E (one by one) from a fund of 100. Instructions emphasize that E is interested in finding out which pictures children think are interesting, which not; and that S can ask for the next picture-pair whenever he is tired of hearing about the picture in hand. All poker chips revert to S at the start of each new picture.

Items were arranged in the following order: (1) frustration (four or five items irrelevant to the incongruity, as "This cow's eyes are very brown."); (2) citing of incongruity ("This cow is wearing a horse's saddle."); (3) frustration (four or five items, as already defined); (4) partial resolution (1 or 2 items, as "The man who owns her put the saddle on."); and (5) complete resolution ("He lets his little boy ride the cow because she is gentler than a horse."). This sequence was also used in supplying information for the normal pictures. For these pictures, an incongruity was introduced verbally after the first four or five items, and an eventual resolution was provided. Item content was very similar for both pictures in a pair. Appendix B contains the game instructions, a sample picture-pair, and the items relevant to it.

Two scoring schemes were applied to the game, both reflecting interest in incongruity (choice of incongruous rather than normal pictures) and persistence in achieving resolution. In the first or "rational" scoring system for the incongruity game, hereafter call IG_1, the range of scores for each picture pair was 0-6, 0 representing selection of the normal picture, 1 point termination during the first set of frustrating items; 2 points, termination upon hearing the incongruity mentioned; 3 points, going one item beyond mention of the incongruity; 4 points, going further into the second set of frustrating items; 5 points, continuing until partial resolution; and 6 points, going to complete resolution or to the items beyond. Scores were summed over the set of eight pictures. (N.B.: Behavior in response to the normal pictures was scored in a similar way in the initial analysis of how the game "works".)

In the second, somewhat more empirically based scoring scheme, which we will call IG_2, the sample on which teacher ratings were available was divided in half. The 20 highest and 20 lowest scoring Ss on the Student Behavior Profile Curiosity Scale were selected from one subsample. The game performance of these contrasting groups was studied in order to arrive at a scoring system that would best discriminate between them. This analysis suggested the use of four picture-pairs and a score based on the actual number of items requested rather than the rational 0-6 scoring outlined above.[5] All subjects in both subsamples were then scored on the more limited set of pictures. The results for the second subsample constituted an attempt to validate the results obtained for the first subsample.

Other measures

Children also were tested (or available information recorded) on a number of other variables pertinent to the validity of the curiosity procedures just described.

The same subsample of Ss that was rated by teachers on the Student Behavior Profile was also rated on an Adjective Checklist which yields curiosity and halo scale scores (Hogan & Greenberger, 1969)[6]. Adjectives which are part of the curiosity scale include: active, daring, alert, interests wide, inventive.[7] Halo scale adjectives include cheerful, considerate, cooperative, mannerly. The first scale was created by asking psychology student "judges" to use Gough's Adjective Checklist (1960) to describe the characteristics of a "curious" child and by

selecting those adjectives on which there was a high degree of consensus. The halo scale was formed by Hogan from previous experience with halo effect.

IQ scores were obtained from school records for nearly all second and third graders in the sample. (IQ tests are not given in first grade.) Mean IQ was 113.7, s.d. 13.2. The mean IQ's of boys and girls were virtually identical.

Grades in three major areas --reading, arithmetic, and social studies --were recorded separately and also averaged for the marking period immediately following testing on the Incongruity Game and ratings made by the teacher. Grades constitute a biased estimate of learning, influenced as they are by halo effect, variations in achievement motivation and other factors. Iowa achievement test scores, which are less subject to teacher bias, were recorded for the small subgroup on whom they were available.

Learning was also assessed under more uniform laboratory-like conditions, and under conditions of less achievement pressure than typical classroom learning. Two "stories" were tape-recorded and played to intact classes. These stories, each of about 5 minutes duration, and devised by the author, contained a great deal of information, much of it novel (e.g., how to teach an elephant to eat disliked foods by manipulating hunger drive and rewards). Recall of story-details was tested one week later in an individual interview. It should be noted that the low achievement pressure assumed to exist refers to these operations: (a) Ss were not told they would be asked any questions about the stories; (b) the story session was conducted in a relaxed way, with the spontaneous

talking and laughter of the pupils not checked; (c) the examiner behaved in an accepting, un-evaluating way, insofar as this is consistent with asking the S questions about the story. It is nonetheless likely that there were variations in children's anxiety about achievement. This anxiety was more likely to operate on recall in the interview than on learning in the classroom session.

Problem-solving ability was assessed on questions like "What would it be like if people could fly?" and "Suppose you went outside and found part of the sidewalk near the school wet: how might it have gotten that way?" Instructions called for as many different kinds of answers as the child could muster.[8] Responses were scored for variety or flexibility of thinking by two scorers. Inter-scorer reliability was near .90. Testing was in an individual interview with a female examiner.[9]

Subjects

Ss were children in the first three grades of a middle-class white suburban school. The 279 children who played the Incongruity Game constitute the original sample, varying portions of which also were examined on the other variables. Table 1 shows the grade and sex composition of the subsamples on each variable.

TABLE 1 ABOUT HERE

RESULTS

The reliability, validity, and relationships of curiosity measures to other variables are described below.

Reliability

The intercorrelation of items on each subscale of the Student Behavior Profile was evaluated separately for each teacher who made ratings. In computing the average intercorrelation over the entire sample of 192 Ss, the average intercorrelation for each teacher was weighted according to the number of Ss she had rated. The reliability of the subscale was then estimated by a procedure roughly equivalent to Hoyt's (1941) procedure and suggested by Julian Stanley (personal communication).[10,11]

The average intercorrelation among items on the curiosity, achievement strivings, and achievement blocks subscales is .51, .37, and .51,

respectively. Every item correlated positively with every other item in its own scale. Reliabilities, in the same order, are .93, .81, and .75. There are no appreciable effects associated with sex or age of the child rated. The small number of items in the two achievement-related subscales depressed reliability. If each had as many items (14) as the curiosity subscale, their reliabilities would be expected to rise to .91 and .90, respectively.

An examination of item-total score correlations reveals that the weakest items on the curiosity subscale are often raises questions and problems; gets excited when something new is introduced; and tries to touch, asks questions about the new or unexpected. The strongest items are tries to figure things out; would rather hear a new than a familiar story; examines, observes, notices carefully; has developed a long term interest; interrupts with questions; and works hard to answer own questions. The first set of items suggests a more diffuse arousal in response to novelty, perhaps intermingled with discomfort (raising questions and problems may betray anxiety more than curiosity); the items which define the subscale better have a more self-sufficient, "comfortable" tone. The weakest item in the achievement subscale is someone at home is sympathetic to the child's wish to do well, clearly because this judgment, unlike the others, is not likely to be based on observable classroom behavior. The best item is has a strong need to do well. The three items on the blocks subscale are about equally good.

Although reliability in all cases is satisfactory, it appears that the scales do not define three independent dimensions: rather, they are interrelated to a considerable degree as shown in Table 2. This is

not surprising since curiosity (as we have defined it), achievement wishes, and absence of achievement blocks all pertain to adequate, competent classroom performance. The higher correlation of curiosity with achievement strivings for girls than boys is a finding of some interest (C.R.=2.37, p .03). It may be that girls' curiosity is channelled more completely along lines compatible with the requirements for achieving well in school.

The average intercorrelation of picture-items in the Incongruity Game is .39 for IG_1, and .56 for IG_2. The reliability associated with these r's is .86 and .84 respectively. No reliability is lost by eliminating the poor pictures from the final score.[12] Boys perform somewhat less consistently than girls on both versions of the game, and the same is true for younger children in comparison with older ones.

The decision to base scoring of the game on incongruous picture choices only was made on theoretical grounds (i.e., consistent with a definition of curiosity stressing selection rather than rejection of incongruity). An empirical analysis of how children's responses to normal pictures are related to their responses to incongruous pictures supports our view that different processes are involved. Each child was given a score according to IG_1, and IG_2 for both normal and incongruous picture choices. The resulting correlations are -.22 and -.19, respectively, both significantly different from zero ($p < .001$ for n=279).

Convergent and discriminant validity

Table 3 shows the relationships between the two new curiosity

measures, IG and Behavior Profile (BP). The relationships are extremely small, indicating that they measure quite different kinds of behavior.

TABLE 3 ABOUT HERE

Table 4 gives the correlations between the new measures and variables relevant to convergent and discriminant aspects of their validity. These correlations are presented separately for boys and girls in Tables 5 and 6.

TABLES 4,5, & 6 ABOUT HERE

IG_1 and IG_2 yielded highly correlated scores (r=.93), and consequently the pattern of their relationships is highly similar. Overall, the game is not impressive. It shows a non-significant association with the Behavior Profile Curiosity subscale, hereafter abbreviated to BPC, in the expected direction (Table 3). The independence of IG from rated achievement strivings or halo characteristics would in other circumstances be felicitous. In the context of so many weak relationships, however, these findings should cast doubt on the nature of the instrument. A significant, though weak, association with Checklist Curiosity is found (Tables 4,5 and 6). More substantial positive correlations would help

to establish IG's validity through "convergence" with other measures of the same variable. The small negative correlation of IC with IQ is contrary to prediction; and contrary to a number of previous findings on the relationship between curiosity and intelligence.

The curiosity scale of the Behavior Profile (BPC) on the contrary does very well. While it relates only weakly to IG (for reasons very likely inherent in the game rather than the rating scale), it shows a remarkably high correlation with the Checklist curiosity measure. (The content of the two scales is not obviously overlapping and their theoretical bases are far from identical.) The individual adjectives which correlate significantly (p.05 or better) with ratings of curiosity on the Behavior Profile include 9 out of 10 adjectives which Hogan calls curiosity-negative and which subtract from the Checklist curiosity score. These adjectives are negatively associated with Behavior Profile Curiosity scores, the most highly associated being dull, meek, shy, timid, and withdrawn. 19 out of 20 curiosity-positive adjectives are related to Behavior Profile Curiosity, especially: energetic, enthusiastic, imaginative, individualistic, adventurous, curious, inventive, and resourceful. The overall pattern and rank order of correlations is quite similar for boys and girls.

BPC also shows desirable relationships to other variables in Table 4: a modest positive association with IQ, and correlations with ratings of halo characteristics and achievement strivings which, though significant, account for only 5% and 25% of the variance, respectively, in BPC scores. Positive relations between IQ and curiosity also have been reported by other investigators (Day, 1968; Hogan and Greenberger,

1969; Maw & Maw, 1964-65). On one variable sex differences are observed (see Tables 5 and 6): halo characteristics show a stronger association with BPC among boys than girls (C.R.=2.05, $p < .05$). One interpretation of this finding is that teachers may prefer curious boys to their female counterparts.

BPC has a negative correlation with the Blocks subscale (BPB)--of the same magnitude as for BPA (Tables 2 and 3). It is clear that some of the same forces which interfere with school achievement also interfere with an interest in approaching and finding out about novel things.

Although the Behavior Profile Achievement subscale (BPA) is not our chief interest, subsequent analysis of the relative importance of curiosity for school achievement requires some familiarity with BPA. BPA shows different strengths of association with other variables for boys and for girls. Achievement strivings are more strongly related to Checklist Curiosity among girls than boys (C.R.=2.05, p .05), mirroring a non-significant trend in the same direction for BPA with BPC (see Table 2). We will have more to say about this finding later. Teachers' ratings of achievement strivings are also more linked with girls' IQ than boys' (C.R.=2.34, p. 02), though in neither this nor the previous case is the association a strong one.

3. Relationship of curiosity to measure of cognitive skills and academic achievement

Table 7 displays the relationship of Behavior Profile subscales and Incongruity Game to grades, achievement test scores, learning-recall, and problem-solving flexibility. Tables 8 and 9 analyze these relationships

separately for the two sexes.

TABLES 7, 8 and 9 ABOUT HERE

It is clear that IG is unrelated to these variables. In neither the previous Tables nor the present ones is there any clear sign that IG is indeed measuring curiosity. Results for the BPC are good: positive relationships are observed with all variables, except boys' Iowa scores. (Correlations of BP subscales with Iowa scores are likely to be very unreliable, based as they are on 12 boys and 10 girls.) Children who score high on BPC perform well in the classroom. Partly this effect may be due to the fact that the teacher is the same "rater" for both grades and BPC. However, BPC also relates to judgments on cognitive skills made <u>independently</u> of the teacher and <u>outside</u> the classroom situation; i.e., problem solving and recall scores. Tables 8 and 9 show no striking sex differences.

Table 7 also reveals sizeable correlations of achievement strivings (BPA) and achievement blocks (BPB) with grades. For BPB, the finding is trivial, since the item-content so closely reflects the teacher's evaluation of a child's academic performance as deficient. However, the small but significant association of BPA and BPB with cognitive skills measured outside the classroom setting by others than the teacher is

again of some interest. Girls who try hard to do well in class, and are not hampered by blocks, appear to try hard and do well in these "extra-curricular" tasks (Table 9). For boys this holds true for problem-solving, but not for learning-recall (Table 8).

Assuming that curiosity, achievement strivings, and achievement blocks operate in a causal way on academic performance, we can ask, what is the relative contribution of each? A regression analysis was performed to examine the effect of IQ and each of the three Behavior Profile subscale scores on Average Grade. Because of certain variations between the sexes (e.g., the greater overlap between BPC and BPA for girls than for boys), separate regressions were carried out.

TABLES 10 and 11 ABOUT HERE

In both cases, a significant amount of variation in the dependent variable is explained by the independent variables: overall, the four variables used in this analysis account for about 48% of the variation in average grade. Some striking sex differences appear in the effect of the individual variables. Looking at the beta weights for each independent variable in Table 10 we see that IQ, blocks, and achievement (in that order) have the greatest effect on boys' average grade. These effects are all significant, whereas the effect of variations in curiosity is not significant. The picture is quite different for girls. Teacher-

assessed blocks have the largest effect on grades; curiosity is more important than IQ; and achievement strivings do not significantly affect average grade. The latter finding is somewhat surprising. The explanation is suggested by another look at Table 2, where one can see the high intercorrelations between curiosity and achievement subscales for girls. The regression analysis shows that the overall correlation of BPA with grades was due to its overlap with BPC. When this overlap is controlled for, the resulting effect of BPA is not significantly different from zero. Since curiosity and achievement <u>are</u> highly related in girls, it appears that the competitive part of this syndrome depresses performance in girls whereas curiosity enhances it.

DISCUSSION

This investigation has netted one disappointment and one success in terms of its goal of creating new approaches to the assessment of curiosity. The Behavior Profile shows fertile relations to other variables; the Incongruity Game is a failure. It is important to ponder over both outcomes.

Three possible explanations, not mutually exclusive of each other, can be suggested to account for the poor showing of the Incongruity Game. Our initial conceptualization of curiosity concentrates on an active cognitive disposition to search out information about puzzling events. With the benefit of hindsight, it seems possible that the game is too passive: it is the examiner who supplies the information, not the

child who, through his own devices, finds explanations. Behavior that was viewed as persistence in solving problems on the part of the child may reflect at least as much willingness to let others solve problems for him.

A second and related explanation of why IG may not "work" is that the more actively curious children may indeed tend to furnish their own solutions to the incongruous pictures and not take great interest in the examiner's resolution. This possibility is consistent with the finding that the more curious children, as measured by BPC, also score high on problem-solving. The problems used in the latter task have certain elements in common with the IG pictures: i.e., several actually present incongruous ideas.

A third avenue of explanation is opened by some interesting findings on test anxiety which have not been described previously. This variable, shows weak positive relations to IG among girls. The relationship of IG to test anxiety increases for both boys and girls from grade 1 through grade 3; the correlation is signficant (p. 05) for the subsamples of girls in grade 2 and grade 3, but not in grade 1. These findings suggest that for some girls, selecting an incongruous picture and asking for relatively much information about it may be a way of allaying anxiety about not knowing. Depending upon different patterns of defense (e.g., position on a repression-sensitization continuum), some anxious individuals will dismiss incongruity from attention while others will be highly alert to its occurrence and resolution. This means that both fearful and enthusiastic players may exhibit the same game-playing style and obtain similar scores. Investigators in other areas of behaviors have found

marked differences in the personality and performance characteristics of individuals with avoidance vs approach types of motivation. The work on fear of failure vs desire to succeed, from the domain of achievement motivation, is a good example (Atkinson, 1964).

It might be possible to re-design the Incongruity Game to take into account these and other present problems with it. The effort does not seem warranted, given the presence of viable alternatives for measuring curiosity. These include both the Checklist (Hogan and Greenberger, 1969) and the Behavior Profile, to which we now turn.

This procedure has a number of strengths which have been documented in the previous section. What can be stressed here is that BPC is not just a measure of intelligence--in fact, it has only a modest overlap with IQ--or of conventional "good" behavior in the classroom. Some portion of the strong fit between BPC and average grade is undoubtedly due to the fact that the teacher may intellectually (vs empirically) associate good school achievement with the kind of behaviors described in BPC (and BPA, and with the absence of behaviors itemized under BPB). But the fact that different behaviors relate to boys' and girls' grades and that BPC also relates to ideational flexibility cannot be explained away. Further investigations are planned at the kindergarten level to determine whether teachers' judgments can be used to predict academic performance in the first grade. If so, the Behavior Profile might be used in a diagnostic fashion that could in turn lead to early intervention in the cognitive and motivational functioning of children with apparent deficits.

The findings concerning the relative effects of IQ, curiosity, achievement strivings and achievement blocks on academic performance have

a number of implications. First of all it should be emphasized that these findings are specific to the sample: middle class children 65% of whom have IQ's between 100 and 126. The weights of the individual variables might well be different in a different social class or IQ range. Exploration of this matter is of considerable interest and is planned in the near future.

The regression analyses provoke some speculation about ways in which the academic achievement of boys and girls might be improved. Since relatively little can be done to alter IQ, let us turn out attention to the remaining variables. Of these, curiosity and achievement strivings seem most within the powers of the teacher to alter. Boys seem to profit gradewise from having a strong competitive need to do well in classroom work. In general, differences in their socialization may create more problems for boys than for girls in readiness to internalize adult standards of classroom decorum and attention or to conform to learning-tasks imposed by the teacher. Coleman (1962) has suggested that the academic efforts of adolescents might be enhanced by introducing team competition into classroom affairs; perhaps similar practices also would be useful for younger boys.

It is not clear why the need to achieve is unrelated to good grades for girls. However, the strong effect of curiosity on grades fits well with arguments advanced in another context by Maccobby (1962). Maccobby argues that the poorer showing of girls, compared with boys, in a variety of investigations on problem-solving skill reflects their training to inhibit risk-taking and to "play it safe." These injunctions may carry over from more outward forms of behavior to the cognitive realm. The

"pacified" behavior of girls in the classroom also emerges in a study by Wallach and Kogan (1965), in which girls were rated by their teachers as more hesitant and subdued than boys, while boys' behavior was more often disruptive. Perhaps BPA is more closely allied with the "good girl" syndrome than BPC, and BPC is more linked with exactly the verve that Maccoby feels is socialized out of girls. Children who score high on Behavior Profile Curiosity (and on Checklist Curiosity) appear to be active and independent. This is clearly the tenor of the items on both measures, as a glimpse at pages 6 and 17 will show. For girls especially, the qualities of activity, independence and curiosity are linked with good learning and academic performance. Whether these characteristics will continue to relate to academic grades over the course of the school years remains to be seen.

The outcome of this investigation illustrates a point which has been made many times (e.g., Getzels and Jackson, 1962). In research on academic performance, IQ rarely accounts for more than one-quarter of the variance in school achievement. This makes it apparent that IQ cannot stand as the only predictive measure of achievement or as our sole criterion of ability or giftedness. This presentation offers some findings on other variables of importance.

Footnotes

[1]Berlyne has suggested a distinction between exploratory behavior that is initiated by a boredom drive and exploratory behavior motivated by a curiosity drive. The former is evoked by departures from optimal activation level (see also Leuba, 1955; and Hebb, 1949) and seeks to restore the individual to a comfortable level and variety of stimulation. Exploration triggered by curiosity occurs as a result of contact with objects or ideas that produce conflict or uncertainty. Exploratory behavior under these conditions has the aim of reducing conflict and the heightened level of activation conflict produces.

[2]See Greenberger, O'Connor & Sørensen (1968) for a description of Beswick's scoring scheme and a revised one by the authors.

[3]In McClelland's system, content similar to the achievement blocks is added to the total motive-strength score. Empirically, "block" imagery did increase, along with the imagery summarized in the achievement strivings items, when McClelland's Ss were placed under achievement-arousing experimental conditions. However, the result may well be due to the frustrating nature of his experimental manipulations and the demands of the task: i.e., to create a dramatic story.

[4]Specifically, each teacher's ratings on each item were standardized. For every child, a standardized score for each item was recorded, as well as a standardized score for each of the three subscales. For use within a single classroom by a single teacher, this laborious procedure is not necessary.

[5]The best picture pairs were numbers 4,5,6 and 8. Except for pair 7, which for some reason appears to be a poor discriminator, it seems likely that the apparent picture failures may in fact be "position" failures. It is reasonable to suppose that a novelty-effect operates during the first several presentations of pictures which obscures individual differences in curiosity. The issue of picture- vs. position-effect regarding pairs 1-3 cannot be explored at present, since the order of pictures was not varied.

[6]Teachers received 75¢ per child rated. Limitations in funds prevented asking all teachers to participate in making ratings.

[7]The nature of this scale (cognitive vs. stimulus seeking) is probably more mixed than either of the new procedures.

[8]Learning and problem-solving procedures were administered in a single two-week period. Student absences on either of the two days when the stories were played in class or recall was tested caused shrinkage in the size of the subsample. Limitations of staff and time produced a ceiling on the number of Ss who could be interviewed for problem-solving.

[9]Findings on learning and problem-solving will be described in greater detail in a forthcoming publication by Greenberger, O'Connor & Sørensen (in press).

[10]Reliability = $\frac{I(\bar{r})}{1+(I-1)(\bar{r})}$, where I is the number of items, and $\bar{r}$ the average intercorrelation among items. This formula is especially useful when $\bar{r}$ is already available.

[11]The psychometric and other characteristics of all three subscales are discussed briefly in this report since there is no other account of them and since these subscales increase our understanding of the curiosity variables.

[12]This does not imply that the pictures can be omitted from the game itself, for reasons discussed earlier.

[13]These characteristics also turn up frequently in studies of creative persons (e.g., MacKinnon, 1962). Regression analysis of the problem-solving data for our sample discloses that curiosity is also related to ideational flexibility. (Greenberger, O'Connor & Sørensen, in press.)

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Table 1

Sex and Grade Composition of Sample on Each Variable

Variable		Grade 1	Grade 2	Grade 3	Total by sex	Grand Total
Incongruity Game[a]	Boys	63	59	29	151	279
	Girls	44	57	27	128	
Behavior Profile[b]	Boys	43	51	12	106	192
	Girls	29	47	10	86	
Adjective Checklist[b]	Boys	43	51	12	106	192
	Girls	29	47	10	86	
Problem Solving	Boys	27	29	29	85	161
	Girls	21	29	26	76	
Recall	Boys	28	24	27	79	150
	Girls	20	27	24	71	
Reading Grade	Boys	33	51	29	113	208
	Girls	21	47	27	95	
Arithmetic Grade	Boys	63	59	29	151	279
	Girls	44	57	27	128	
Social Studies Grade	Boys	63	55	29	147	273
	Girls	44	55	27	126	
Average Grade	Boys	63	59	29	151	279
	Girls	44	57	27	128	
Iowa (Vocabulary, Reading & Arith.)	Boys	--	--	28	28	54
	Girls	--	--	26	26	
IQ	Boys	--	59	29	88	172
	Girls	--	57	27	84	

[a] Children who played the Incongruity Game constitute the original sample, varying numbers of which were assessed on the other variables in this study.

[b] Children rated on one were also rated on the other.

Table 2

Correlations Among Subscales of Student Behavior Profile

	All Ss[+] (n = 192)	Boys (n = 106)	Girls (n = 86)
Curiosity and Achievement	.59	.48	.70
Curiosity and Blocks	-.63	-.57	-.69
Achievement and Blocks	-.66	-.57	-.75

[+]Correlations in this column when corrected for attenuation are .87. .84, and .78.

Table 3

Relationship of Behavior Profile Scores and Incongruity Game

	IG_1			IG_2		
	All S (n = 192)	Boys (n = 106)	Girls (n = 86)	All Ss (n = 192)	Boys (n = 192)	Girls (n = 86)
BPC	.09	.05	.15	.12	.12	.12
BPA	-.09	-.09	-.08	-.09	-.06	-.12
BPB	.07	.09	.03	.06	.02	.11

Table 4

Relations Among New Procedures, "Halo" Characteristics, and IQ: All Ss

New Procedures	Checklist Curiosity	Checklist Halo	IQ
Behavior Profile Curiosity	.72*** (n = 192)	.24** (n = 192)	.30** (n = 120)
Behavior Profile Achievement	.28** (n = 192)	.41*** (n = 192)	.16* (n = 120)
Behavior Profile Blocks	-.36*** (n = 192)	-.33*** (n = 192)	-.15 (n = 120)
IG 1	.18* (n = 192)	-.05 (n = 192)	-.06 (n = 172)
IG 2	.21 (n = 192)	-.01 (n = 192)	-.08 (n = 172)

* p .05
** p .01
*** p .001

Table 5

Relations Among New Procedures, "Halo" Characteristics, and IQ: Boys

New Procedures	Checklist Curiosity	Checklist Halo	IQ
Behavior Profile Curiosity	.72*** (n = 106)	.29** (n = 106)	.33*** (n = 63)
Behavior Profile Achievement	.16* (n = 106)	.41*** (n = 106)	.04 (n = 63)
Behavior Profile Blocks	-.29** (n = 106	.29** (n = 106)	-.13 (n = 63)
IG 1	.11 (n = 106)	-.02 (n = 106)	.02 (n = 88)
IG 2	.17* (n = 106)	.05 (n = 106)	.05 (n = 88)

* p .05
** p .01
***p .001

Table 6

Relations Among New Procedures, "Halo" Characteristics, and IQ: Girls

New Procedures	Checklist Curiosity	Checklist Halo	IQ
Behavior Profile Curiosity	.73*** (n = 86)	.18* (n = 86)	.26* (n = 57)
Behavior Profile Achievement	.42*** (n = 86)	.41*** (n = 86)	.32** (n = 57)
Behavior Profile Blocks	-.44*** (n = 86)	.37*** (n = 86)	-.19 (n = 57)
IG 1	.25** (n = 86)	-.07 (n = 86)	-.17* (n = 84)
IG 2	.24** (n = 86)	-.06 (n = 86)	-.22** (n = 84)

* p .05
** p .01
*** p .001

Relationship of Behavior Profile and IG Scores to Grades, Achievement Tests, and Cognitive Skills: All Ss

New Procedures	Grades				Achievement Tests			Cognitive Skills	
	Reading Grade	Arith. Grade	Soc. St. Grade	Average Grade	Iowa Voc.	Iowa Read.	Iowa Arith.	Recall	Problem Flex.
Behavior Profile Curiosity	.52***	.49***	.47***	.55***	.40	.64***	.45**	.38***	.38***
Behavior Profile Achievement	.36***	.41***	.47***	.48***	.38*	.62***	.42*	.31**	.31**
Behavior Profile Blocks	-.51***	-.52***	-.50***	-.59***	-.61***	-.83***	-.50***	-.17*	-.22*
IG 1	-.04	-.08	-.01	-.04	-.04	-.11	-.13	.07	.08
IG 2	-.04	-.09	-.02	-.04	-.08	-.16	-.13	.07	.10

+For n, consult Table 1 and take the smaler of the n's for the two variables correlated.

* p .05
** p .01
*** p .001

Table 7

Relationship of Behavior Profile and IG Scores to Grades, Achievement Tests, and Cognitive Skills: Boys[+]

New Procedures	Grades				Achievement Tests			Cognitive Skills	
	Reading Grade	Arith. Grade	Soc. St. Grade	Average Grade	Iowa Voc.	Iowa Read.	Iowa Arith.	Recall	Problem Flex.
Behavior Profile Curiosity	.52***	.46***	.44***	.52***	.01	.40	.12	.30*	.41**
Behavior Profile Achievement	.36***	.37***	.43***	.46***	-.02	.43	-.06	.17	.34**
Behavior Profile Blocks	-.50***	-.50***	-.43***	-.54***	-.42	-.84***	-.13	-.03	-.24*
IG 1	-.02	-.05	-.02	-.04	-.08	-.07	-.10	.07	.12
IG 2	.01	0.00	.06	.03	-.17	-.13	-.07	.07	.12

[+]For n, consult Table 1 and take the smaller of the n's for the two variables correlated.

* p .05
** p .01
*** p .001

Table 8

Relationship of Behavior Profile and IG Scores to Grades, Achievement Tests, and Cognitive Skills: Girls[+]

New Procedures	Grades				Achievement Tests			Cognitive Skills	
	Reading Grade	Arith. Grade	Soc. St. Grade	Average Grade	Iowa Voc.	Iowa Read.	Iowa Arith.	Recall	Problem Flex.
Behavior Profile Curiosity	.54***	.53***	.50***	.60***	.65**	.83***	.79***	.49***	.37**
Behavior Profile Achievement	.36**	.45***	.50***	.51***	.63**	.77***	.88***	.47**	.30*
Behavior Profile Blocks	-.53***	-.54***	-.58***	-.63***	-.78***	-.84***	-.94***	-.35**	-.22
IG 1	-.04	-.11	-.02	-.04	.01	-.18	-.15	.09	.06
IG 2	-.09	-.17	-.04	-.10	0.00	-.20	-.18	.08	.08

[+]For n, consult Table 1 and take the smaller of the n's for the two variables correlated.

* p .05
** p .01
*** p .001

Table 9

Table 10

Regression of (1) IQ; (2) Curiosity[a]; (3) Achievement Strivings[a]; and (4) Blocks[a] on Average Grade: Boys[b]

	Standardized regression coefficient	t for regression coefficient
Beta (1)	.329	5.10**
Beta (2)	.137	1.71[+]
Beta (3)	.201	2.64*
Beta (4)	-.308	-3.84**

F ratio = 32.37* (df 3,88).

Intercept = 163.184

Multiple R Square = .47

[a]Refers to Behavior Profile subscales.

[b]n for IQ and average grade is 106; n for the remaining variables and average grade is 88.

[+]$p > .05 < .10$

*$p < .01$

**$p < .001$

Table 11

Regression of (1) IQ; (2) Curiosity[a]; (3) Achievement Strivings[a]; and (4) Blocks[a] on Average Grade: Girls[b]

	Standardized regression coefficient	t for regression coefficient
Beta (1)	.234	3.43**
Beta (2)	.297	3.06*
Beta (3)	-.116	-1.08
Beta (4)	-.462	-4.42**

F ratio = 29.78* (df 3,76)

Intercept = 196.576

Multiple R Square = .49

[a]Refers to Behavior Profile subscales.

[b]N for IQ and average grade is 84; n for the remaining variables and average grade is 76.

*p < .01

**p < .001

Appendix A

Behavior Profile

For the following ratings, put a checkmark at the space on the line where this child stands relative to others in the class.

Try to recall <u>specific</u> behaviors of the child after reading each item and before making your rating. It will help us greatly if you can reach a judgment on all items.

1. Likes group activities better than "solo" activities		Prefers "solo" activities to group activities
2. Tends to wonder about, become fascinated by a variety of things		Tends not to wonder about, become fascinated by a variety of things
3. Has developed a long-term interest in a single task or project		Has not developed a long-term interest in a single task or project
4. Does not examine, observe, notice carefully		Does examine, observe, notice carefully
5. Enjoys drill on numbers		Does not enjoy drill on numbers
6. Gets excited, interested when something new or unexpected is introduced		Does not get excited, interested when something new or unexpected is introduced
7. Does not try to figure things out or find possible explanations for things		Does try to figure things out or find possible explanations for things
8. Interested in people who are different from himself		Not interested in people who are different from himself

9. Actually experiments, tries things out — Does not actually experiment, or try things out

10. Does not usually raise questions and problems — Often raises questions and problems

11. Does not interrupt with questions during story-time — Interrupts with questions during story-time

12. Enjoys coloring in mimeographed pictures — Does not enjoy coloring in mimeographed pictures

13. Likes to try to solve problems — Dislikes trying to solve problems

14. Would rather hear a familiar than a new story — Would rather hear a new than a familiar story

15. Avoids, does not ask questions about the new or unexpected — Tries to touch, or asks questions about the new or unexpected

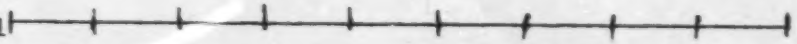
16. Does not particularly like to learn new things — Loves to learn new things

17. Enjoys drill on letters and spelling — Does not enjoy drill on letters and spelling

18. Tends to stop trying when it is hard to discover the answer to a question he has asked — Doesn't mind working hard to find the answer to a question he has asked

19. Likes to have his expectations about things disconfirmed — — Likes things to be "normal," as expected

20. Has a strong need to do things well — — Does not have a strong need to do things well

21. Does not seem to feel great pleasure when he has done something well —  — Feels great pleasure when he has done something well

22. Tries hard to do well on schoolwork: practices, drills, studies — — Does not try particularly hard to do well in schoolwork: doesn't practice, drill, study

23. Spontaneously tries again when he has failed — — Has to be coaxed to try again when he has failed

24. Expects to do poorly — — Expects to do well

25. Wants to do better than the others in his schoolwork — — Wants to do less well than others in his schoolwork

26. Probably someone at home is sympathetic and helpful with regard to his wish to do well — — Probably no one at home is sympathetic and helpful with regard to his wish to do well

27. Does not especially want approval for doing well — — Tries to do well in hopes of winning approval

28. Things happen (accidents, forgetting, etc.) that interfere with his school achievement

Things do not happen (accidents, forgetting, etc.) that interfere with his school achievement

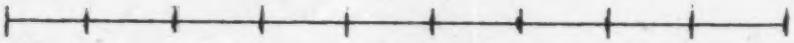
29. Feels bad when he has not done something well

Does not feel bad when he has not done something well

30. Does not seem blocked in his ability to do well

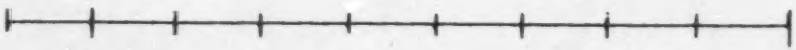
Seems blocked in his ability to do well

31. Tries to do well because he likes feeling competent



Isn't especially interested in feeling competent

32. Liked by girls in class



Not liked by girls in class

33. Liked by boys in class

Not liked by boys in class

34. Enjoys helping the teacher

Does not enjoy helping the teacher

35. Enjoys helping classmates

Does not enjoy helping classmates

Appendix B

Game Instructions

Sample Picture-Pair and Items

Instructions

We're trying to learn something about the pictures that children your age think are interesting, and the pictures they think are not so interesting. So we're going to play something like a game, (child's name). See this pile of things? It's a pile of pictures. See these pages? They tell things about the pictures. The way you find out about the pictures is to push one of these chips over to my side of the table. Then I'll tell you something about it. If you push over another chip, I'll tell you another thing. You can push over as many or as few chips as you want, depending on how interested you are in finding out more about the pictures.

I will show you two pictures at a time, and you tell me which one you'd like to know more about. When you give <u>one</u> of these chips, I'll read you <u>one</u> thing about the picture. Each time you want to know more, give me another chip and I'll tell you another thing it says about the picture.

Don't feel you have to give me lots and lots of chips if you really aren't interested in hearing about the picture. There are lots of pictures (point) and lots of things written down about them. <u>You may want to know more about some pictures than others. Only give me chips as long as you are interested in knowing more about the picture.</u> When you get tired of hearing about one picture, tell me you want to go on to the next.

Do you understand?

Information

Incongruous

1. Lucy's mother made her dress.
2. She just picked a bunch of flowers.
3. She's on her way to her aunt's house.
4. Her aunt will give her a coke when she gets there.
5. The ground must be soft, since there are footprints in it.
6. The footprints behind her don't look like hers at all.
7. There are no footprints of her bare feet anywhere to be seen.
8. She is 4 1/2 years old.
9. She likes walking around in her neighborhood.
10. The footprints belong to a man who was walking there earlier today.
11. Some workmen has just poured cement for a new sidewalk and the man walked on it while it was still wet.
12. It's dry now, so Lucy doesn't leave any footprints.
13. Why did the man walk on wet cement?
14. Whose footprints go deeper in the ground, a girl's or a grown ups?

Congruous

1. Lucy's mother made her dress.
2. She just picked a bunch of flowers.
3. Lucy is on her way to her aunt's house to give the flowers to her.
4. Her aunt will give her a coke when she gets there.
5. Lucy will not give the flowers to her aunt.
6. She knows her aunt loves flowers.
7. She is 4 1/2 years old.
8. She likes to walk around her neighborhood.
9. Lucy dropped the flowers and did not stop to pick them up.
10. She dropped them when she heard some thunder.
11. Lucy is afraid of thunder and ran as fast as she could to her aunt's house.
12. Does Lucy ever wear shoes?
13. Lucy wonders if her aunt will be sorry not to have the flowers.
14. Will Lucy pick some more flowers for her aunt?